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The Effect of Seedbed Density on Development of Septoria Leaf Spot on White Alder at Humboldt Nursery

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ABSTRACT

White alder were thinned to various seedbed densities to determine if increased spacing would reduce damage due to Septoria leaf spot caused by Septoria alnifolia. Plots thinned to densities of 20 and 40 seedlings per square foot, with and without monthly benomyl (Benlate 8 oz/100 gals) applications, were compared to unthinned (approximately 50 seedlings/per square foot) plots. Density did not have a significant effect (p=0.05) on height, caliper or disease severity. Monthly benomyl sprays did significantly reduce disease severity; there were no significant differences in height and caliper (p=0.05). Monthly benomyl (8 oz/100 gals) sprays would be beneficial to control Septoria leaf spot on white alder, but it is no longer registered for nursery use.

INTRODUCTION

Septoria leaf spot, caused by the fungus Septoria alnifolia, has been a persistant pest at the Humboldt Nursery since white alder was added to its crop production regime. In 1988, nearly 150,000 white alder seedlings, over 90% of the crop, were lost due to fungal infection. The fungus causes black spots on leaves and stems; if infection occurs when the seedlings are small, the lesion girdles the stem, killing the seedling. Red alder is less susceptible to Septoria; necrotic spots develop on its lower leaves but fewer infections result in mortality.

In 1989, benomyl was shown to be an effective fungicide for the control of Septoria leaf spot on white alder (Frankel 1990). Septoria was controlled by monthly benomyl (Benlate) applications, from May through November, at a rate of 8 oz/100 gals. The monthly applications reduced disease losses to less than 5% of the crop.

Although chemical control was adequate, alternative nonchemical control methods are being sought to reduce risks to human health and the environment. One promising cultural control method is thinning to reduce seedbed density. Under crowded conditions relative humidity increases, air stagnates, and plants are stressed due to competition, making the environment more conducive to fungal infection. This trial was designed to determine whether thinning to reduce seedbed density would limit Septoria leaf spot development while still allowing for the production of properly sized alder seedlings.

METHODS

Plots were established in white alder seedbeds at the USDA Forest Service Humboldt Nursery in northern California. A randomized complete block design was used with 5 treatments replicated 4 times. Each replicate measured 6 feet long and was one nursery bed wide (4 feet). The following seedling densities and chemical treatment combinations were compared:

1. White alder thinned to 20 per square foot. No chemical treatment.
2. White alder thinned to 40 per square foot. No chemical treatment.
3. White alder thinned to 20 per square foot and sprayed with benomyl (Benlate) 8 oz/100 gals, applied monthly from the date first leaf is fully extended till lifting.
4. White alder thinned to 40 per square foot and sprayed with benomyl (Benlate) 8 oz/100 gals, applied monthly from the date first leaf is fully extended till lifting.
5. Untreated white alder, operationally sown (approximately 50 seedlings per square foot), not thinned.

To thin the plots to 20 or 40 per square foot, seedlings were clipped at the soil line when the seedlings were 2" tall and discarded. Thinnings were done so the seedlings remaining in the beds were evenly spaced.

Fungicide was applied using a backpack sprayer with foliage sprayed to run-off.

On November 26, 1991 near the end of the growing season, 20 randomly selected seedlings from each plot were harvested for disease evaluation and growth measurements. Seedlings were clipped at the soil line; height, and caliper at the base were measured; and disease severity rated. Disease severity was visually estimated and rated on a 5 point scale where 1 = less than 20% of foliage infected, 2 = 21-40% of foliage infected, 3 = 41-60% of foliage infected, 4 = 61-80% of foliage infected, 5 = 81-100% of foliage infected. Analysis of variance was used for comparison of means. An arcsine transformation was done on the disease rating variable to convert percentages, which have a binomial distribution, into a normal distribution.

RESULTS AND DISCUSSION

Reduced seedbed density did not control Septoria leaf spot on white alder. Plots not treated with benomyl, including those with low density, had seedlings with premature defoliation and heavy spotting due to Septoria leaf spot. The disease severity rating of the "thinned--no chemical treatment" plots was nearly identical to the "unthinned--no chemical treatment" plot (See Table 1).

Septoria leaf spot was adequately controlled in the plots that were sprayed monthly with benomyl; most seedlings from treated plots had much less than 20% of their foliage infected. Spacing made little difference in the chemically treated plots, with nearly identical results for the treated 20/sq. ft. vs. 40/sq. ft. plots (See Table 1).

Seedling height and caliper showed no significant differences (p=0.05) between all plots. Although seedling height and caliper were on average greater for chemically treated vs. untreated seedlings, variation between replicates was high.

Table 1. Disease severity, height and caliper of white alder seedlings grown at various bed densities with or without monthly benomyl treatment. Values are means of 80 randomly selected seedlings per treatment.

Treatment	Disease Rating[1]	Height	Caliper
Density -- Fungicide		cm	mm
20 seedlings/sq. ft. -- no sprays	4.8a[2]	18.3a	4.5a
40 seedlings/sq. ft. -- no sprays	5.0a	20.0a	4.3a
20 seedlings/sq. ft. -- benomyl	1.4b	24.3a	5.6a
40 seedlings/sq. ft. -- benomyl	1.1b	29.5a	5.7a
Unthinned 50 seedlings/sq. ft. -- no sprays	5.0a	13.5a	3.0a

[1] Disease rating is based on a 5 point scale, where 1 = less than 20% of foliage, 2 = 21-40% of foliage infected, 3 = 41-60% of foliage infected, 4 = 61-80% of foliage infected, 5 = 81-100% of foliage infected.

[2] Values followed by the same letter are not significantly different (p=0.05).

The nursery registration for Benlate (benomyl) has been withdrawn by the manufacturer (Dupont). Apparently the nursery market was not large enough to cover the cost of registration, testing and other expenses. Topsin E and Cleary 3336 are chemical alternatives to benomyl with the same active ingredient (methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate or MBC). Duosand is a combination of MBC and mancozeb which might be useful for control of Septoria leaf spot and to prevent the development of fungal resistance. However, mancozeb alone did not control Septoria leaf spot in the 1989 Humboldt Nursery trial (Frankel 1990). A trial is scheduled for the 1992 growing season to test these alternatives to benomyl for control of Septoria leaf spot on red and white alder.

Humboldt nursery is also cooperating with the Oregon State University Hardwood Cooperative on a trial examining fertilization rate and planting density to perfect alder seedling size and condition. The target seedbed density for the 1992 alder crop has been lowered from the 1991 target of 40-60 seedlings/square foot, to 15-30 seedlings/per square foot based on the preliminary results from this trial.

SUMMARY

Reducing white alder seedbed density did not reduce Septoria leaf spot damage severity on white alder. Monthly benomyl sprays did significantly ($p=0.05$) reduce disease severity; there was no significant difference in height or caliper for all treatments. Monthly benomyl (8oz/100 gals) sprays would be beneficial to control Septoria leaf spot on white alder, but it is no longer registered for this use. Alternative fungicides, with the same active ingredient as benomyl, will be tested in the 1992 growing season.

LITERATURE CITED

Frankel, S. 1990. Evaluation of Fungicides to Control Septoria Leaf Spot on White Alder at Humboldt Nursery. Forest Pest Management Report No. R90-02. USDA Forest Service, Pacific Southwest Region. 4p.

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